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Service-Oriented Architecture and Organizational Integration: An Empirical Study of IT-Enabled Sustained Competitive Advantage

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Abstract

Organizational integration is a phenomenon occurring inexorably in recent years due to rapid advances in IT and intense competition. Past research has found organizational integration, between and within firms, to be positively-related to performance, with IT resources playing a pivotal role in facilitating this trend. In this paper, we argue that IT resources, comprising of IT assets and capabilities, are critical antecedents to organizational integration. We examine the role of service-oriented architecture (SOA) as an IT asset in enabling organizational integration. As an IT-dependent strategic initiative, IT-enabled organizational integration provides significant barriers to competition and gives rise to sustained competitive advantage. Drawing upon the resource-based and configuration theories, we developed a model by conceptualizing both SOA and IT capabilities as higher-order constructs comprising of IT standards and IT architectural design, and IT technical skills and managerial skills respectively. Next, we explore the effects of causal ambiguity to further elucidate the relationship between organizational integration and sustained competitive advantage. Our results provide managers and researchers with invaluable insights to understand the business value of service-oriented computing to achieve organizational integration and to sustain competitive advantage.

Keywords: business value of IT, service-oriented architecture, organizational integration, causal ambiguity, sustained competitive advantage

Introduction

Organizational integration has been occurring at an increasing scale in recent years due to the emergence of new information technologies (IT). This trend is intensified by the spate of internal reorganizations, business process re-engineering efforts, and multitude of mergers and acquisitions over the last few years. Organizations are engaging in hitherto unseen levels of integration in order to obtain competitive advantage (Markus 2001; Porter 2001). Driven by academic research that generally shows a positive relationship between integration and performance (e.g., Ettie and Reza 2001; Truman 2000), organizations believe that it is imperative for them to achieve increasingly high degrees of organizational integration in order to attain sustained competitive advantage.

Ample past literature has attributed the declining competitiveness of the American industry to the fact that its competitors (particularly the Japanese) have attained competitive advantage by becoming more organizationally integrated than their rivals (e.g., Lazonick and West 1998). Within the American industry itself, companies that have succeeded in being more integrated than their competitors have achieved above-normal profits, with a notable example being Dell, with its tight "virtual integration" business model and heavy use of IT to enable coordination across company boundaries and to deliver high velocity built-to-order computer systems (Magretta 1998). Another example is Wal-Mart, with its highly efficient supply chain integrated seamlessly into all aspects of its business, which is still unmatched by its competitors (Piccolo and Ives 2005). As the extent of intra-enterprise and inter-enterprise integration increasingly determine competitive advantage, it is hence important for practitioners and academics alike to better understand the performance implications of such integration efforts and how organizational integration can be further enhanced by leveraging on information technology.

Existing enterprise systems and technologies comprise organic infrastructure that is simply too unwieldy and expensive to manage. Coupled with the aforementioned business challenges that are evolving at an unprecedented rate, many organizations face a formidable task in adapting to the modern business paradigm. Enterprises must be more dynamic and agile than ever to survive, using innovative and evolved ways of handling the competition. Service-Oriented Architecture (SOA) represents a new technology paradigm to tackle the massive integration changes occurring in many business processes, alliances, mergers, acquisitions, amongst many others, while offering a coalescing rubric (Bierberstein et al. 2006). Its core strengths lie in its ability to enhance integration connectedness while promoting flexibility - two crucial traits required for survival and success in the future enterprise landscape. SOA has been suggested to lead to application integration and deployment savings, software service reusability and improved organizational agility (Pisello 2006). It streamlines internal business operations because of the ease in integrating with legacy systems and existing software assets by providing an overlay that can allow disparate systems to communicate. In addition, it also allows more flexible integration with trading partners and offers organizations the ability to create applications and services that enhance the reach and richness of organizational integration (Chen 2005; Hagel 2002).

In this paper, we advance a model through synthesizing previous research from the fields of information systems and strategic management to examine how IT-enabled sustained competitive advantage could be attained through organizational integration. Drawing upon the resource-based and configuration theories, we develop a structural model linking a firm's IT resources, comprising of SOA and IT human resources capabilities, to the levels of organizational integration, and subsequently to the sustained competitive advantage resulting from it. Specifically, we aim to achieve the following research objectives. First, we attempt to further improve our understanding of exactly is meant by "organizational integration"? Past literature has defined the concept in diverse and non-specific terms which provide difficulty when attempts to operationalize the concept are made. The term remains vague, with varying meanings within different industry contexts and little attempt was made to reconcile them. Second, how do emerging technologies such as SOA enhance organizational integration of a firm? Finally and perhaps most importantly, how does integration actually impact the various organizational outcomes, most notably sustained competitive advantage? We believe that our framework provides a much needed foundation to guide managerial decisions and future research in the increasingly turbulent business environment where integration and inter-networking serve as the critical means for extended enterprises to leapfrog the competition.

Conceptual Foundations

Overview of Organizational Integration

Organizational integration (OI) has been conceptualized rather differently by the various fields, such as strategic management, information systems (IS), and operations management (e.g. Barki and Pinsonneault 2005; Chandra and Kumar 2001; Glouberman and Mintzberg 2001), with the reason being that each field focuses on its own area of organizational activities or components. In the strategic management literature, integration has been defined as "the process of achieving unity of effort among the various subsystems in the accomplishment of the organization's tasks" (Lawrence and Lorsch 1986) and as "the coordination of activities and the management of the dependencies between them" (Glouberman and Mintzberg 2001). An oft-repeated theme in the literature has to do with organizations which have strong functional walls, in that they are frequently slower to adapt to fast changing environments, thus strengthening the case for integration (Bartlett 1995). In the field of logistics and operations, integration is perceived as the coordinated management of information, material flows, plant operations, and logistics through a common set of principles, strategies, policies, and performance metrics (Chandra and Kumar 2001; Lee and Billington 1993). Interdepartmental integration has also been defined as "the willingness of departments to work together, which emphasizes working together, having mutual understanding, having a common vision, sharing resources, and achieving collective goals" (Kahn and Mentzer 1998).

In the IS domain, the concept of OI has been studied in two main ways. From a technical point of view, integration represents the extent to which different systems are interconnected and can talk to one another (Chiang et al. 2000; Goodhue et al. 1992). The other perspective views integration as the extent to which the business processes of two or more independent organizations are standardized and tightly coupled through computers and telecommunications technologies (Dan et al. 2001; Malone et al. 1999; Srinivasan et al. 1994; Truman 2000). Internet technologies, Enterprise Resource Planning (ERP) systems, mass customization, and supply chain management, are clear portents of initiatives which have been made in this area (Braganza 2002). Braganza (2002) also further delineated the various types of OI along 3 attributes: i) characteristics, in which integration can be characterized as the co-operation between teams and functions (Millson and Wilemon 2002); ii) scope, referring to the extent of the functions to be integrated, and finally iii) elements, which refers to organizational elements which need to be integrated, such as strategy and culture (Fuchs et al. 2000).

Though the concept of OI varies widely across domains, they share some common characteristics. In this paper, we adopt the definition of organizational integration as the "extent to which distinct and interdependent organizational components constitute a unified whole" (Barki and Pinsonneault 2005). The term "component" denotes organizational units, departments, or partners including the business processes, people, and technology involved (Leavitt 1971). Barki and Pinsonneault (2005) further describe organizational integration in terms of the processes which are internal or external to an organization (Porter 1985; Williamson 1985). The integration of internal processes *within* a firm is described as internal OI, whereas the integration of processes *between* firms and across boundaries of the firm can be referred to as external OI. Additionally, internal and external processes can be further subdivided into those which pertain to primary (operational) or secondary activities (functional). Primary activities are those such as manufacturing, while secondary activities are represented by administrative functions like finance and human resources. Finally, adopting Williamson's (1985) framework, external operational processes can be categorized according to whether they are forward, backward, or laterally directed, with regard to their clients, suppliers, or partially assembled products respectively.

Service-Oriented Architecture and Organizational Integration

In this study, we regard SOA as a core IT asset that enables organizational integration. SOA is primarily concerned with the design and deployment of modular services to support application interoperability and organizational integration. Applications use these services by composing them together. Such architecture has three main parts: a provider, a consumer, and a registry (Huhns and Singh 2005). According to Bierberstein et al (2006), the term SOA can be defined in several ways. Narrowly defined, SOA is "an acronym for solution architectures making use of Web service technologies such as SOAP, WSDL, and UDDI", with this architecture conforming to the W3C Web Services Architecture (W3A). Broadly speaking, SOA refers to "an enterprise-wide IT architecture that promotes

loosely-coupled and interoperable components (services), built as application functions, which improve flexibility and reuse."

In order to obtain a holistic conceptualization, we incorporated both the narrow and broad definitions of SOA in our operationalization. We conceptualized IT assets in the form of service-oriented architecture (SOA), and as a second-order construct comprising of IT standards and IT architectural design. IT standards largely refer to the use of application design standards, namely those most commonly utilized by service-oriented architecture (e.g. XML, WSDL, SOAP etc). IT architectural design refers to the extent to which an organization has implemented its application architecture in line with the service-oriented architecture/computing paradigm. This conceptualization has been supported by several authors and practitioners (Bierberstein et al. 2006; Bloomberg and Schmelzer 2006).

It must be noted that past studies on OI have mostly focused on ERP systems in facilitating integration, an approach that warrants reexamination. EAI (Enterprise Application Integration) technology, an aspect of which comprises ERP, has been proven to be brittle and expensive, partly due to the fact that they utilize proprietary technologies. Each EAI vendor controls the technology in its particular offering, reducing interoperability and allowing the vendor to charge indiscriminately (Bloomberg and Schmelzer 2006). The main drawback of EAI technology is that it focused on establishing point-to-point connection. By leveraging open standards on completely new processes, SOA allows organizations to integrate all elements of the business while avoiding problems inherent in various incarnations of EAI.

Theoretical Mechanisms Underlying Organizational Integration

The resource-based theory of the firm provides great efficacy in understanding the inherent value created when integration occurs (Sirmon and Hitt 2003). Barney's (1991) seminal article contends that all firms have resources (consisting of assets and capabilities), while successful firms possess a unique subset of resources which enables them to achieve competitive advantage, and a further subset which leads to superior long term performance (Wernerfelt 1984). Furthermore, Barney (1991) posits that resources help in attaining sustained competitive advantage when they fulfill requirements in four areas: value, rareness, imperfect imitability, and non-substitutability. Wade and Hulland (2004) have extended the resource-based view to render it more useful for IS research. Recent literature has suggested that in highly turbulent and hypercompetitive settings (Teece et al. 1997), strategic advantages are gained by integrating and reconfiguring resources into bundles, which are then used in strategy formulation (Eisenhardt and Martin 2000; Sirmon and Hitt 2003). Though the resource-based view has come under attack from many quarters, for being non-generalizable and having constructs which are difficult to operationalize, amongst others, we opine that true competitive advantage does not accrue from a few resources or capabilities, but instead involves complex networks of interacting and evolving resources (Black and Boal 1994; Dierickx and Cool 1989; Lavie 2006; Levitas and Nodofor 2006).

The above leads us logically to the concept of causal ambiguity. Causal ambiguity has been defined variously, as a barrier which makes imitation difficult, and thus provides competitive advantage that "resists erosion by competitor behavior" (Porter 1985). It has also been defined as "the phenomenon surrounding business actions and outcomes that makes it difficult for competitors to imitate strategies" (Lippman and Rumelt 1982). With regard to the resource-based view, causal ambiguity has been conceptualized as a dimension of imperfect imitability, or "inimitability", a trait that certain resources (or networks/configurations of resources) possess which allows their owner to achieve sustained competitive advantage. This concept of inimitability in terms of causal ambiguity has been operationalized by strategy researchers (e.g. King and Zeithaml 2001).

Sustained Competitive Advantage

Sustained competitive advantage (SCA), accrued through IT-dependent strategic initiatives, has remained a point of contention among strategy and IS researchers. Competitive advantage is created "when value produced in an economic exchange in which the firm partakes is greater than the value that could be created were the firm not to participate in the exchange" (Brandenburger and Stuart 1996). Sustainability, on the other hand, is not quite so easy to define. Porter (1985) has defined it as a condition where "a firm's competitive advantage resists erosion by a competitor's behavior", and which requires that the firm possesses barriers which makes imitation of the strategy difficult. Barney (1991) in explicating the resource-based view, went on to say that "a competitive advantage is sustained only if it continues to exist after efforts to duplicate that advantage have ceased", a definition which faces obvious problems when one attempts to operationalize it (Wiggins and Ruefli 2002). This is because it implies the

notion that sustained competitive advantage is any competitive advantage which lasts forever, which is clearly impossible. It was even stated philosophically that competitive advantage is not a necessary and sufficient condition for superior returns, and that competitive advantage is but a metaphor (Powell 2001). There are obvious difficulties to measuring SCA when it has been conceptualized in such nebulous terms.

We thus adopt a more pragmatic formulation of sustained competitive advantage, consistent with that of Mata et al. (1995) and Piccoli and Ives (2005), in that it accrues when "competitors face significant challenges in acquiring, developing, and using" the resources underlying the value creating strategy. In doing so we acknowledge the role of barriers to erosion and response lag drivers in creating sustained competitive advantage. Based on Piccoli and Ives (2005), four barriers to erosion exist which allow IT-dependent strategic initiatives to sustain their performance: the IT resources barrier (consisting of IT infrastructure, information repositories, technical skills, IT management skills, and relationship assets), complementary resources barrier, IT project barrier, and pre-emption barrier (switching costs and value system structural characteristics between firms).

Research Model and Hypotheses

Figure 1 depicts our proposed model.

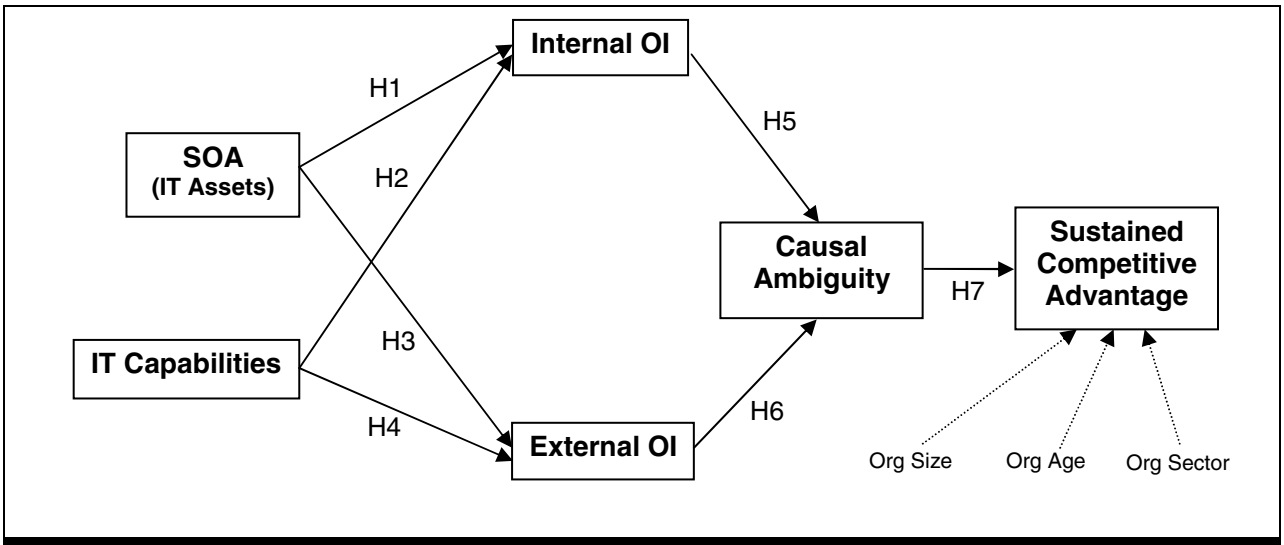

Figure 1. Model of IT-enabled Organizational Integration and SCA

IT Resources as Antecedents of Organizational Integration

IT resources can be defined in terms of *assets* (tangible or intangible) for example information systems hardware, network infrastructure, and *capabilities*, which refers to skills for example technical/managerial ability which transform inputs to outputs of greater worth (Amit and Schoemaker 1993; Wade and Hulland 2004).

We view organizational integration as an IT-dependent strategic initiative, consisting of identifiable competitive moves that depends on the use of IT to be enacted, and are designed to lead to sustained improvements in a firm's competitive position. It refers to a configuration of IT resources into an activity system, dependent on IT at its core, which fosters the creation and appropriation of economic value (Piccoli and Ives 2005). Hence, both IT assets and IT capabilities are complementary resources in enabling organizational integration.

Rockart and Short (1989) have argued that IT serves primarily to manage organizational interdependence and solve coordination problems among departments and strategic business units. Consistent with the resource-based and configurational views, IT resources, like other resources, are sources of competitive advantages when configured in a network and when they complement each other (Wade and Hulland 2004). Melville et al. (2004) acknowledge that in order to contribute to organizational performance, IT resources, consisting of technology and human resources (analogous to assets and capabilities in our context) and complementary organizational resources have to be bundled and configured, with industry and country characteristics playing a role as part of the external environment.

Within a firm, IT resources are mandatory when it comes to internal organizational integration. Human, business, and IT resources within the firm are recognized as drivers of firm performance when they are well-integrated across the organization (Powell and Dent-Micallef 1997; Walton 1989). In addition, the quality of the IT resources also plays a defining role in facilitating external organizational integration. Dell, Toys R US, and Wal-mart use sophisticated inventory management technologies to link up with their suppliers to improve operational efficiencies and services (Powell and Dent-Micallef 1997). Without IT resources, many of the integration initiatives which have taken place in recent years would never have materialized.

Service-oriented architecture, in providing loosely coupled, flexible services, can allow an organization to expose a selected set of resources, services, and processes to its customers, partners, either internally to other parts of the organization. These same services can be recombined and supplemented to support changes such as integration (Bierberstein et al 2006). For example, a car parts manufacturer can use SOA to expand to support new brands and integrate new parts catalogues seamlessly without impacting its own business processes. The use of SOA in organizations has been suggested to lead to improved intra-organizational integration as well as inter-organizational integration (Chen 2005).

We regard IT capabilities as a complementary resource to IT assets. We conceptualized IT capabilities as a second-order constructs made up of IT management skills and IT technical skills. The former refers to the ability to provide leadership for the IS function, manage IT projects, and evaluate technology options (Mata et al. 1995). Managerial skills are also believed to significantly reduce the costs and lead times associated with IT development (Bharadwaj 2000), and assist in envisioning creative and feasible technical solutions to business problems, thus enhancing the overall technological capability of an organization (Feeny and Willcocks 1998). Technical skills refer to the ability to design and develop effective information systems. This is inclusive of being proficient in system analysis and design, infrastructure design, and programming, amongst others (McKenney et al. 1995). Firms that possess higher level of IS human resource capabilities have been found to achieve more superior firm performance (Ravichandran and Lertwongsatien 2005). In our context, we would likewise expect that a high level of IT capabilities would be required to develop service-oriented applications and manage the service-oriented computing platform required for organizational integration.

Hence, we posit that:

Hypothesis 1 (H1): Higher level use of SOA in an organization will lead to higher degree of internal organizational integration.

Hypothesis 2 (H2): Higher level of IT capabilities in an organization will lead to higher degree of internal organizational integration.

Hypothesis 3 (H3): Higher level use of SOA in an organization will lead to higher degree of external organizational integration.

Hypothesis 4 (H4): Higher level of IT capabilities in an organization will lead to higher degree of external organizational integration.

Organizational Integration, Causal Ambiguity and SCA

Our understanding of internal and external organizational integration can be further enriched by drawing upon Black and Boal's (1994) notion of contained resources and system resources. Contained resources, comprise of simple networks of resource factors which can be monetarily valued, while system resources, consisting of complex networks of firm resource factors. Networks can consist of two types: local and structural (Berkowitz 1982; McCallister and Fischer 1983).

Synthesizing network theory and the resource-based view, local networks are the configurations of relationships within a level of analysis among the factors, and where the entire network results in a resource. A structural network is the configuration of relationships between local networks and between a factor of a local network and other networks and factors. Local networks usually refer to the configuration of the internal resources of an organization (McCallister and Fischer 1983), while external configuration of resources outside of its local network constitutes its structural network (Berkowitz 1982). When conceptualized in this way, a strategic system resource is a socially created complex network comprised of tradable and non-tradable factor stocks and flows (resources) and their relationships, which with local network dimensions of tradability, acquisition, network types, substitutability, and

cogency, provides complexity which competitor firms cannot imitate and exploit. This is in line with Piccoli and Ives's (1995) notion of pre-emption barriers to erosion; as such networks of factors often provide impediments for competitors to attain competitive advantage even if they have amassed the individual resources comprising the network itself.

Next, in order to gain deeper insights into the outcomes of organizational integration, we considered the configurational perspective. The configuration theory suggests that the configuration of the firm can be assessed as the degree to which an organization's elements are orchestrated, closely aligned, reinforcing each other and all connected by a single theme (Miller 1996). A high degree of configuration also delivers many valuable benefits, such as synergy, clarity of direction and coordination, difficulty of imitation, and distinctive competence, amongst others (Black and Boal 1994; Miller 1993; Porter 1985). Lavie (2006) makes a useful distinction between shared and non-shared resources, and illustrates how various internal and external factors influence the composition of rents extracted by the focal firm in an alliance.

Hence, we would expect that firms that have achieved a high level of organization integration through configuring their resources internally and externally would attain a high degree of resource inimitability, represented by causal ambiguity. Causal ambiguity represents a continuum that describes "the degree to which decision makers understand the relationships between organizational inputs and results" (Lippman and Rumelt 1982). Because strategic issues are intrinsically messy and managers boundedly rational, almost all conclusions regarding strategic resources and their outcomes are causally ambiguous (King 2007). In particular, we would expect to observe a greater degree of such ambiguity in organizations which are more tightly integrated, due to difficulty in isolating and identifying the factors of success of one's competitors. Hence, we hypothesized that:

Hypothesis 5 (H5): The degree of internal organizational integration in an organization is positively related to the degree of causal ambiguity.

Hypothesis 6 (H6): The degree of external organizational integration in an organization is positively related to the degree of causal ambiguity.

A greater extent of organizational integration strengthens *complexity,* one of the three core aspects of causal ambiguity (namely *complexity, tacitness,* and *specificity*), which according to Reed and DeFillippi (1990), generate causal ambiguity individually or in combination with each other. *Complexity* results from having a large number of interdependent skills and assets, which results particularly when integration is strengthened. *Tacitness* refers to the implicit and non-codifiable accumulation of skills that result from learning by doing. *Specificity* refers to the transaction-specific skills and assets that are utilized in the production processes and provision of services for particular customers. Any or all of these competency characteristics can increase ambiguity between the firm's business actions and outcomes that create its advantage. This, in turn, creates barriers to imitation. King (2007) states that "the greater the interconnectedness of a firm's competencies, the greater the level of interfirm causal ambiguity." This concept ties in well with Piccoli and Ives (2005) notion of barriers to erosion, which is imperative to sustained competitive advantage. Causal ambiguity about key competencies of a firm generates strategically significant consequences. Causal ambiguity has been linked to interfirm differences in profitability (Lippman and Rumelt 1982), amongst others. Hence, more complex networks of resources created through organizational integration would create higher levels of sustained competitive advantage.

Hypothesis 7 (H7): The degree of causal ambiguity that a firm possesses is positively related to its degree of sustained competitive advantage.

Research Methods

Operationalization of Constructs

In accordance with our theoretical arguments and review of the literature made earlier, both SOA and IT Capabilities were operationalized as second-order constructs, with IT Standards and IT Architectural Design, and IT Management Skills and IT Technical Skills making up their first-order constructs respectively. The instrument to measure SOA was self-developed based on conceptual papers on service-oriented computing (e.g, Huhns and Singh 2005), while scales for IT Capabilities were developed based on numerous studies of the resource-based conceptualization of IT Resources (e.g., Piccolo and Ives 2005; Powell and Dent-Micallef 1997; Wade and Hulland 2004). IT Standards were assessed by four questions which asked the respondent to score from a scale of 0 to 100 the percentage of IT applications in their firm which uses XML, WSDL, SOAP and UDDI. These four standards were selected because they form the core of Web Services, which is the most common implementation of SOA. IT Architectural Design assessed the extent that the organization conforms to the characteristics of SOA in their IT application. Both the Internal Organizational Integration and External Organizational Integration constructs were self-developed based primarily on the theoretical work of Barki and Pinsonneault (2005). Consistent with the arguments in King's (2007) study, we have developed the instrument to measure causal ambiguity in a similar manner. Specifically, we are only concerned with interfirm causal ambiguity and not intrafirm causal ambiguity. Finally, we derived the measurement for sustainable competitive advantage from Piccolo and Ives (2005). We expect three variables, namely firm size, organization age and industry sector to influence sustained competitive advantage. Firm size was coded as the *log* of the number of employees, and organizational age was coded as the *log* of the number of years since the organization was first established, using 2007 as a base. The industry sector was dummy-coded for different industry sectors.

Survey Data Collection

The sample of our survey was drawn from the "Singapore 1000" (S1000) directory, which list the nation's largest corporations by annual financial performance of sales/turnover. Our final sampling frame comprise of 868 companies after screening firms that are holding companies with no commercial activities as well as subsidiary companies. We conducted the survey using a three-wave mailing procedure. We prepared a package consisting of a cover letter stating the objective of the study, a copy of the questionnaire, and a prepaid reply envelope. This package was then mailed to each of the 868 firms identified. The target of our survey was the top executive in charge of IT in the firm, such as the CIO or the IT Director, who are likely to be key decision makers related to the management and use of IT in their organizations. Respondents were also motivated to provide valid data by the offer of receiving a summarized copy of the research results and an invitation to a free workshop presenting the research findings. This enhanced the possibility of obtaining professional and accurate data from the respondents. About two weeks after the initial mailing, a reminder postcard was sent to each of the companies. Following that, a complete survey packages was mailed again to the non-respondents. A total of 188 complete responses were received, representing a response rate of 21.7%[1]. This is considered a reasonable figure, given that the survey was unsolicited and involved the participation of senior management. We assessed non-response bias by verifying that early and late respondents did not significantly differ in their demographic characteristics and responses on principal constructs (Armstrong and Overton 1977), with T-tests showing insignificant differences. Common method bias was also assessed and was not found to be a problem. Table 1 shows the demographics of the sample population.

[1] Data collected as of March 18, 2007.

Table 1. Demographics of Sample Population			
	Category	**Number**	**%**
Respondent Position	CIO, IT Director, IT Manager	118	62.77
	Other Departmental Managers, Systems Administrators	33	17.55
	Executives	15	7.98
	Others	22	11.70
Industry Sectors	Services	30	15.96
	Shipping and Transport	19	10.11
	Retail	13	6.91
	Property and Construction	17	9.04
	Utilities	4	2.21
	Finance	13	6.91
	Wholesale – Equipment and Machinery	10	5.32
	Wholesale – Petroleum, Chemical Products and Raw Materials	23	12.23
	Manufacturing – Electrical and Electronics	33	17.55
	Manufacturing – Petroleum, Chemical Products and Material Processing	26	13.83
Number of Employees	50 and less	18	9.57
	51-100	29	15.43
	101-200	29	15.43
	201 and above	112	59.57
Company Age (Years)	Less than 10	23	12.23
	10 - 20	44	23.40
	21 - 30	59	31.38
	31 and above	62	32.98

Data Analysis and Results

Partial Least Square Analysis

Partial Least Square (PLS), a structural equation modeling technique that includes measurement error and supports the inclusion of latent variables (Hulland 1999) was selected to assess our model. PLS-Graph version 3 was used. PLS was chosen for the following reasons. PLS is a more preferred technique for prediction-oriented studies such as ours as it seeks to maximize the variance explained in constructs (Barclay et al. 1995). Our sample size of 188 meets and exceeds the PLS requirement of ten times the number of indicators in the most complex formative construct (Barclay et al. 1995). Several constructs in the research model are formative and cannot be modeled adequately using covariance-based tools. PLS allows latent constructs to be modeled as either formative or reflective. Additionally, PLS can assess the measurement model and deal with the relationships between questions and constructs within the context of the structural model, which then deals with relationships among constructs (Fornell 1982). The PLS model was assessed in two stages. In the first stage, the measurement model was examined to assess the reliability and validity of measures. Following that, the structural model was examined in the second stage.

Measurement Model Evaluation

Discriminant Validity

Discriminant validity is the degree to which items measure different constructs (Cook and Campbell 1979). It was examined by checking the correlations between the measurement items of distinct constructs against the average variance extracted (AVE) by construct (Fornell and Larcker 1981). Table 2 reports the results of the discriminant validity test for the constructs. The diagonal elements are the AVE for each construct, and they are all shown to be higher than the squared inter-construct correlations depicted in the off-diagonal elements.

Table 2. Discriminant Validity of Constructs

Construct	IOI	EOI	CAU	SCA	SOA	ITC
Internal OI (IOI)	**0.826**					
External OI (EOI)	0.252	**0.828**				
Casual Ambiguity (CAU)	0.082	0.052	**0.563**			
Sustained Competitive Advantage (SCA)	0.076	0.083	0.100	**0.756**		
Service-Oriented Architecture (SOA)	0.282	0.097	0.072	0.033	**0.658**	
IT Capabilities (ITC)	0.358	0.089	0.050	0.042	0.386	**0.911**

Reliability and Convergent Validity

Table 3 below shows the descriptive statistics and first-order item loadings for the constructs. All constructs had Cronbach's alpha value of 0.707 or larger indicating adequate internal consistency (Nunnally and Bernstein 1994). Convergent validity refers to the degree to which the items measuring the same construct agree (Cook and Campbell 1979). We used three tests to determine the convergent validity of our constructs: item loading, composite reliability of construct and the AVE extracted by construct. All item loading were above 0.707 (Chin 1998) and composite reliabilities of all constructs were also above the minimum value of 0.7 (Fornell and Larcker 1981). The AVE for all constructs were above 50% as well. These evaluations provided evidence for sufficient reliability and convergent validity.

Table 3. Descriptive Statistics of Constructs and Item Loadings for First-Order Components

Constructs	Item Loading
IT Technical Standard (Mean=19.970; S.D.=22.000; Cronbach's Alpha=0.904; Composite Reliability=0.939; AVE=0.794)	
Extended Markup Language (XML)	0.816
Web Services Descriptor Language (WSDL)	0.905
Simple Object Access Protocol (SOAP)	0.927
Universal Description, Discovery, and Integration (UDDI)	0.914
IT Architectural Design (Mean=4.318; S.D.=1.210; Cronbach's Alpha=0.915; Composite Reliability=0.936; AVE=0.747)	
Our IT applications contain reusable components.	0.8154
Our IT applications contain components that are modular.	0.8524
Our IT applications are able to interact with one another autonomously without human intervention.	0.8623
Our IT applications are interoperable with one another through common interfaces.	0.8899
Our IT applications can be configured flexibly and dynamically.	0.8980

Table 3. Descriptive Statistics of Constructs and Item Loadings for First-Order Components (cont'd)	
Constructs	Item Loading
IT Management Skills (Mean=5.228; S.D.=1.117; Cronbach's Alpha=0.949; Composite Reliability=0.962; AVE=0.834)	
Our organization fully exploits our range of IT resources when implementing various organizational strategies.	0.885
Our organization's IT strategy is aligned with our business strategy.	0.935
Our organization has the know-how to evaluate available IT options sufficiently when deciding upon which one to use.	0.922
Our IT function and business functions have established a good relationship.	0.926
Our IT specialists work well with our users in the business functions.	0.897
IT Technical Skills (Mean=5.142; S.D.=1.087; Cronbach's Alpha=0.934; Composite Reliability=0.953; AVE=0.835)	
Our IT staff are knowledgeable about how to use IT effectively to facilitate business processes.	0.939
Our IT staff have the ability and expertise to perform their technical duties well.	0.906
Our IT staff are able to develop and implement technological initiatives well.	0.922
Our IT staff understand the link between IT and business functions.	0.888
Internal OI (Mean=5.110; S.D.=1.094; Cronbach's Alpha=0.965; Composite Reliability=0.971; AVE=0.826)	
The business processes of our operational departments are well integrated with one another.	0.921
Our operational departments have business processes which are standardized for information exchange.	0.908
Information is shared effectively across our operational departments.	0.911
The business processes of our support departments are well integrated with one another.	0.942
Our support departments have business processes which are standardized for information exchange.	0.926
Information is shared effectively across our support departments.	0.923
Overall, the integration between our operational and support departments is high.	0.826
External OI (Mean=4.122; S.D.=1.255; Cronbach's Alpha=0.965; Composite Reliability=0.971; AVE=0.828)	
The business processes of our operational departments are well integrated with those of our partner organizations.	0.881
Our operational departments are well interconnected with those of our partner organizations.	0.906
Information is shared effectively across the operational departments of our organization and our partner organizations.	0.919
The business processes of our support departments are well integrated with those of our partner organizations.	0.931
Our support departments are well interconnected with those of our partner organizations.	0.916
Information is shared effectively across the support departments of our organization and our partner organizations.	0.909
Overall, the integration between the operational and support departments of our organization and those of our partner organizations is high.	0.908
Causal Ambiguity (Mean=4.374; S.D.=0.860; Cronbach's Alpha=0.741; Composite Reliability=0.837; AVE=0.563)	
The technology/business process know-how held by our organization is easily known to other organizations. (reverse-coded)	0.733
Our competitors can easily understand the factors that are responsible for our sources of success. (reverse-coded)	0.739
The association between inputs and outcomes related to the technology/business process know-how held by our organization is not clear to other organizations.	0.804
The connection between actions and results of our organization is not obvious to our competitors.	0.722
Sustained Competitive Advantage (Mean=4.527; S.D.=1.048; Cronbach's Alpha=0.891; Composite Reliability=0.925; AVE=0.756)	
We are able to retain our strategic advantage over competitors for a period of time.	0.769
Our competitors face difficulties imitating our organization's value creating strategies.	0.909
Our competitors take a significant amount of time in order to imitate our organization's strategies.	0.928
Our competitors face significant disadvantages in acquiring the resources necessary to implement our organization's strategies.	0.863

Structural Model Evaluation

Having confirmed the existence of good psychometric properties in the measurement model, we examined the structural model to assess the explanatory power and the significance of the paths. PLS does not generate an overall goodness of fit index, so the primary assessment of validity is by examining R^2 and the structural paths (Chwelos et al. 2001). A boot-strapping resampling procedure was used to estimate the significance of the path coefficients. Since PLS-Graph does not directly permit the modeling of second-order constructs with first-order constructs, we followed the approach employed by Yi and Davis (2003). We first computed the first-order factor scores and then used them as manifest indicators of the second-order constructs. Results of the PLS analysis are presented in Figure 2 below. All control variables were not significant.

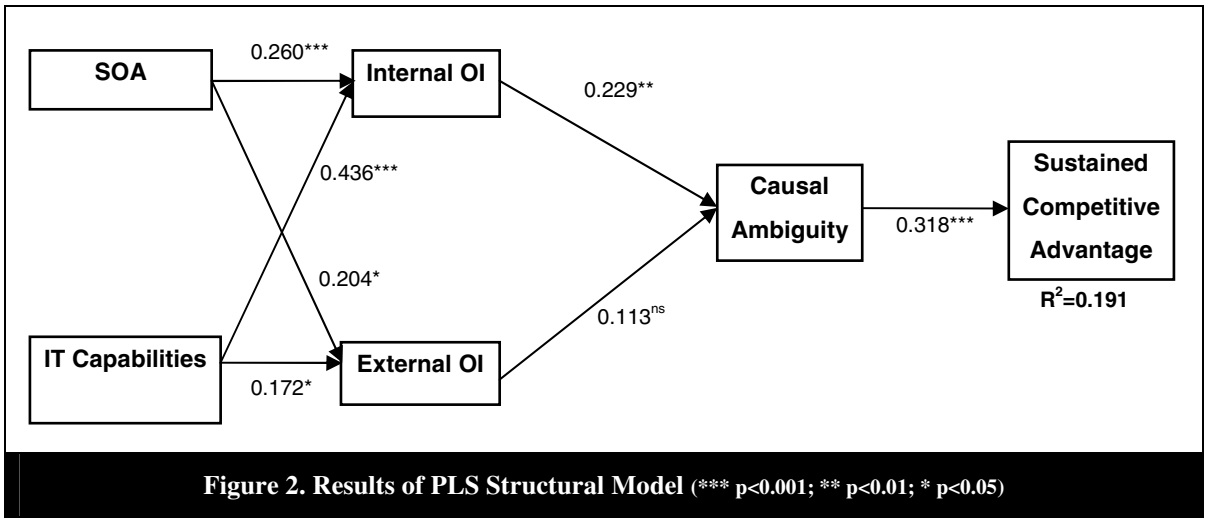

Figure 2. Results of PLS Structural Model (* p<0.001; ** p<0.01; * p<0.05)**

Discussion and Implications

Key Findings

The IT resources constructs (SOA and IT Capabilities) in the structural model could explain 39.9% of the variance in internal organizational integration and 11.5% of the variance in external organizational integration. SOA contributes almost equally and significantly to internal and external integration. This result suggests that the SOA is able to provide loosely-coupled and interoperable services to enhance flexibility for the integration of various organizational processes within the firm and with business partners. Our findings also demonstrate that IT Capabilities, in the form of IT management skills and IT technical skills, impact both forms of integration significantly. However, the ensuing benefit of increasing such capabilities improves internal organizational integration more strongly compared to external organizational integration. The presence of IT capabilities has a greater effect on intrafirm integration, presumably due to the fact that such integration is more easily controlled by the individual organizations. Examining the antecedent effects of IT resources for both SOA and IT capabilities, we observe that generally IT resources do not have as strong an impact on the integration attained with partner firms, which depends to a large extent on other non-technical factors as well as technical factors beyond the control of the organization.

The finding that higher level of internal organization integration enhances the degree of causal ambiguity attests to the inimitability of resources due to integration. This dovetails with the networked resource-based view and configurational perspective, which suggests that configuration of resources into a network of connected assets enhances the difficulty for imitation (Black and Boal 1994; Miller 1996). The hypothesized effect of external organizational integration to causal ambiguity was not significant. The level of external integration for the firms in our sample is relatively lower than the level of internal integration (M_{EOI} = 4.122 versus M_{IOI} = 5.110). This is not unexpected given that despite the advances in technologies (e.g. SOA) that can facilitate organizational integration, not every organization in every industry sector utilizes such technology to attain a significant level of integration

with its partners. In addition, we believe that external integration contributes less to causal ambiguity due to the fact that such integration is usually more visible to competitors and thus make it easier to emulate.

Overall, the model could explain 19.1% of the variance in IT-enabled sustained competitive advantage. The effect of causal ambiguity in enhancing sustained competitive advantage is significant. This suggests that for firms that have attained high levels of causal ambiguity, competitors would find it difficult to fully comprehend the factors behind their success. This allows them to enjoy sustained competitive advantage.

Managerial and Theoretical Implications

The results offer numerous managerial implications. First, we provide empirical evidence from recent data that service-oriented architecture can indeed enhance organizational integration. This emerging technology possesses immense potential to facilitate both internal and external integration, and will certainly be one of the most promising IT initiatives that deserves attention. Next, findings also show that IT capabilities are important for organizational integration as well. However, it must be noted that not all integration initiatives are equally important and contribute equally to achieving results (Braganza 2002). Hence when faced with resource constraints, managers would need to exercise their strategic choice in deciding what IT assets or IT capabilities to invest in. Managers should also be mindful that organizational integration is definitely an IT-dependent strategic initiative that is also industry specific and dependent on the external business environment.

Our findings also make several important theoretical contributions. It elucidates the process through which IT can enable organizations to attain sustained competitive advantage. First, it formally reconciles the resource-based view of organizational integration by infusing network and configurational perspectives to the study. The empirical findings affirm that this approach has enriched our understanding of the antecedents and well as the consequents of organizational integration. Examining internal and external organizational integration separately also enables us to glean richer insights into the nature of organizational integration. Second, this study represents one of the first attempts to examine the effects of an important emerging technology, SOA in the context of organizational integration together with IT capabilities as complementary resources. Most significantly, the operationalization and empirical validation of the notion of causal ambiguity in an organizational integration context advances our knowledge of the barriers to erosion of IT-enabled sustained competitive advantage. It provides evidence that it is the configurations and networks of resources, not the resources themselves, are sources of superior performance. Causal ambiguity provides a clear and intuitive linkage between the theories of the resource-based view and that of sustained competitive advantage. The resource-based view posits that the attribute of inimitability is imperative in achieving such advantage and causal ambiguity provides explanatory power for this due to the fact that inimitability is one of its inherent qualities (Newbert 2007). Causal ambiguity, with its barriers of imitation, correlates strongly with the oft-mentioned barriers to erosion of sustained competitive advantage. This is a significant contribution to both information systems and strategic management literature.

Limitations and Directions for Future Research

The interpretation of the findings should take into consideration that data was collected in Singapore, a small technologically-advanced country with unique economic environment. Nevertheless, our dataset comprises of local as well as foreign companies from diverse industry sectors. In addition, while we have performed rigorous tests to rule out potential biases in the responses, we must acknowledge that the inherent biases of single informant could be present. Hence, future research should attempt to replicate the study in other countries, and ideally to multiple respondents. Since different countries are in varying stages of technological maturity, especially in the adoption of SOA. It would also be necessary to refine the conceptualization and definition of SOA as the technology develops and matures. The present study only examined the four most commonly implemented SOA standards, namely XML, SOAP, WSDL and UDDI. Future work should certainly look at other emerging standards such as Business Process Execution Language (BPEL) as adoption of those standards increases. Furthermore, we only studied SOA in isolation of other mature technologies that could be coexisting in the organization. Future work could examine the effects of SOA together with other existing forms of enterprise application integration (EAI) technology, in order to gauge their relative ability to facilitate organizational integration. Next, a longitudinal study is recommended to examine the sustainability of competitive advantage, which, by definition, requires the conceptualization of a longer timeframe. Finally, the role of service-oriented computing can be explored in other contexts besides organizational integration. Businesses require responsiveness and agility, something which SOA can provide. Given the rate at

which markets evolve, it is almost impossible to carry out long term planning, and thus being able to plan on a rolling basis with corresponding technological flexibility would allow the organization to reap huge benefits. More research can be done in this area, and results would certainly make significant contributions.

Conclusion

The objective of this paper is to examine the role of service-oriented architecture (SOA) as an IT asset in enabling organizational integration. As an IT-dependent strategic initiative, IT-enabled organizational integration provides significant barriers to competition and gives rise to sustained competitive advantage. Drawing on the conceptual foundations of resource-based view and configuration theory, we developed a structural model to explore the effects of IT resources on organizational integration. We also examined the notion of causal ambiguity to further elucidate the relationship between organizational integration and sustained competitive advantage. We hope that the exploratory findings arising from this study would serve as a useful foundation for future researchers to explore the business value of service-oriented computing, which is set to become a burgeoning research area for the information systems field.

References

Amit, R., and Schoemaker P. J. H. "Strategic Assets and Organizational Rent," *Strategic Management Journal* (14), 1993, pp. 33-46.

Armstrong, J. S. and Overton, T. S. "Estimating Non-response Bias in Mail Surveys," *Journal of Marketing Research* (14), Aug 1977, pp. 396-402.

Barclay, D., Higgins, C., and Thompson, R. "The Partial Least Squares Approach to Causal Modeling: Personal Computer Adoption and Use as an Illustration," *Technology Studies* (2:2), 1995, pp. 285-324.

Barki, H., and Pinsonneault, A. "A Model of Organizational Integration, Implementation Effort, and Performance," *Organization Science* (16:2), March-April 2005, pp. 165-179.

Barney, J. B. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17), 1991, pp. 99-120.

Bartlett, C. A. "The New Global Challenge Implementing Third-generation Strategy through Second-generation Management," in *In Charge of Change: Insights into Next-Generation Organizations,* Ready, D. C. (Ed), International Consortium for Executive Development Research, Lexington, MA, 1995, pp. 19-33.

Berkowitz, S. D. *An Introduction to Structural Analysis: The Network Approach to Social Research*, Butterworth, Toronto, Canada, 1982.

Bharadwaj, A. S. "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation," *MIS Quarterly* (24:1), 2000, pp. 169-196.

Bierberstein, N., Bose, S., Fiammante, M., Jones, K., and Shah, R., *Service-Oriented Architecture Compass: Business Value, Planning, and Enterprise Roadmap*, IBM Press, Upper Saddle River, NJ, 2006.

Black, J. A., and Boal, K. B. "Strategic Resources: Traits, Configurations, and Paths to Sustainable Competitive Advantage," *Strategic Management Journal* (15:Special Issue), 1994, pp. 131-148.

Bloomberg, J., and Schmelzer, R. *Service Orient or Be Doomed!,* John Wiley & Sons, Hoboken, NJ, 2006.

Braganza, A. "Enterprise Integration: Creating Competitive Capabilities," *Integrated Manufacturing Systems* (13:8), 2002, pp. 562-572.

Brandenburger, A. M., and Stuart, H. W. "Value-Based Business Strategy," *Journal of Economics and Management Strategy* (5:1), 1996, pp. 5-24.

Chandra, C., and Kumar, S. "Enterprise Architectural Framework for Supply Chain Integration," *Industrial Management Data Systems* (101:6), 2001, pp. 290-303.

Chen, M. "An Analysis of the Driving Forces for Web Services Adoption," *Information Systems and e-Business* (3), 2005, pp. 265-279.

Chiang, R. H. L., Lim, E., and Storey, V. C. "A Framework for Acquiring Domain Semantics and Knowledge for Database Integration," Data Base (31:2), 2000, pp. 46-64.

Chin, W. W. "The Partial Least Square Approach to Structural Equation Modeling," in *Modern Methods for Business Research*, Marcoulides, G. A. (Ed.), Lawrence Erlbaum, Mahwah, NJ, 1998, pp. 295-336.

Chwelos, P., Benbasat, I., and Dexter, A. S. "Research Report: Empirical Test of an EDI Adoption Model," *Information Systems Research* (12), 2001, pp. 304-321.

Cook, M., and Campbell, D. T. *Quasi-Experimentation: Design and Analysis Issues for Field Settings*, Houghton Mifflin, Boston, MA, 1979.

Dan, A., Dias, D. M., Kearney, R., Lau, T. C., Nguyen, T. N., Parr, F. N., Sachs, M. W., and Shaikh, H. H. "Business-to-Business Integration with tpaML and a Business-to-Business Protocol Framework," *IBM Systems Journal* (40:1), 2001, pp. 68-90.

Dierickx, I., and Cool, K. "Asset Stock Accumulation and Sustainability of Competitive Advantage," *Management Science* (35), 1989, pp. 1504-1511.

Eisenhardt, K. M., and Martin, J. A. "Dynamic Capabilities: What Are They?," *Strategic Management Journal* (21), 2000, pp. 1105-1121.

Ettie, J. E., and Reza, E. M. "Organizational Integration and Process Innovation," *Academy of Management Journal* (35:4), 2001, pp. 795-827.

Feeny, D. F., and Willcocks, L. P. "Core Is Capabilities for Exploiting Information Technology," *Sloan Management Review* (39:3), 1998, pp. 9-21.

Fornell, C. *A Second Generation of Multivariate Analysis Methods*, Volume 1, Praeger, New York, 1982.

Fornell, C., and Larcker, D. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research* (18:1), 1981, pp. 39-50.

Fuchs, P. H., Mifflin, K. E., and Whitney, J.O. "Strategic Integration: Competing in the Age of Capabilities," *California Management Review* (42:3), 2000, pp. 118-147.

Glouberman, S., and Mintzberg, H. "Managing the Care of Health and the Cure of Disease – Part II: Integration," *Health Care Management Review* (26:1), 2001, pp. 70-84.

Goldhue, D. L., Wybo, M. D., and Kirsch, L. J. "The Impact of Data Integration on the Costs and Benefits of Information Systems," *MIS Quarterly* (16:3), Sep 1992, pp. 293-311.

Hagel, J. *Out of the Box: Strategies for Achieving Profits Today and Growth Tomorrow through Web Services*, Harvard Business School Press, Boston, MA, 2002.

Huhns, M., and Singh, M. P. "Service-Oriented Computing: Key Concepts and Principles," *IEEE Internet Computing* January/February 2005, pp. 75-81.

Hulland, J. "Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent Studies," *Strategic Management Journal* (20:2), 1999, pp. 195-204.

Kahn, K. B., and Mentzer, J. T. "Marketing's Integration with other Departments," *Journal of Business Research* (42), 1998, pp. 53-62.

King, A. W. "Disentangling Interfirm and Intrafirm Causal Ambiguity: A Conceptual Model of Causal Ambiguity and Sustainable Competitive Advantage," *Academy of Management Review* (32:1), 2007, pp. 156-178.

King, A.W., and Zeithaml, C. P. "Competencies and Firm Performance: Examining the Causal Ambiguity Paradox," *Strategic Management Journal* (22:1), 2001, pp. 75-99.

Lavie, D. "The Competitive Advantage of Interconnected Firms: An Extension of the Resource-Based View," *Academy of Management Review* (31:3), 2006, pp. 638-658.

Lawrence, P. R., and Lorsch, J. W. *Organization and Environment: Managing Differentiation and Integration*, Harvard Business School Press, Boston, MA, 1986.

Lazonick, W., and West, J. "Organizational Integration and Competitive Advantage," *Industrial and Corporate Change* (4), 1998, pp. 229-270.

Leavitt, H. J. "Change in Industry: Structural, Technical and Human Approaches," in Vroom, V. H., and Deci, E. L. (Eds.), *Management and Motivation: Selected Readings,* Penguin Books, New York, 1971.

Lee, H. L., and Billington, C. "Material Management in Decentralized Supply Chains," *Operation Research* (41:5), 1993, pp. 835-847.

Levitas, E., and Ndofor, H. A. "What to Do with the Resource-Based View: A Few Suggestions for What Ails the RBV that Supporters and Opponents Might Accept," *Journal of Management Inquiry* (15:2), 2006, pp. 135-144.

Lippman, S., and Rumelt, R. "Uncertain Imitability: An Analysis of Interfirm Differences in Efficiency Under Competition," *Bell Journal of Economics* (13), 1982, pp. 418–438.

Magretta, J. "The Power of Virtual Integration: An interview with Dell Computer's Michael Dell," *Harvard Business Review,* March-April 1998, pp. 73-84.

Malone, T. W., Crowston, K. Lee, L., Pentland, B., Dellacoras, C., Wyner, G., Quimby, J., Osborn, C. S., Bernstein, A., Herman, G., Klein, M., and O'Donnell, E. "Tools for Inventing Organizations: Toward a Handbook of Organizational Processes," *Management Science* (45:3), 1999, pp. 425-443.

Markus, L. M. "Reflections on the System Integration Enterprise," *Business Process Management Journal (*7:3), 2001, pp. 1-9.

Mata, F. J., Fuerst, W. L., and Barney, J. B. "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis," *MIS Quarterly* (19:4), 1995, pp. 487-505.

McCallister, L., and Fisher, C.S. "A Procedure for Surveying Personal Networks," in Burt, R.S. and Minor, M. J. (Eds.), *Applied Network Analysis: A Methodological Introduction*, Sage Publications, Beverly Hills, 1983, pp. 75-88.

McKenney, J. L., Copeland, D. C., and Mason, R. O. *Waves of Change: Business Evolution Through Information Technology*, Harvard Business School Press, Boston, MA, 1995.

Melville, N., Kraemer, K., and Gurbaxani, V. "Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value," *MIS Quarterly* (28:2), 2004, pp. 283-322.

Miller, D. "Configurations Revisited," *Strategic Management Journal* (17:7), 1996, pp. 505-512.

Miller, D. "The Architecture of Simplicity," *Academy of Management Review* (18), 1993, pp. 116-138.

Millson, M. R., and Wilemon, D. "The Impact of Organizational Integration and Product Development Proficiency on Market Success," *Industrial Marketing Management* (31), 2002, pp. 1-23.

Newbert, S. L. "Empirical Research on the Resource-based View of the Firm: An Assessment and Suggestions for Future Research," *Strategic Management Journal* (28), 2007, pp. 121-146.

Nunnally, J.C., and Bernstein, I. *Psychometric Theory*, 3rd edition, McGraw-Hill, New York, 1994.

Piccolo, G., and Ives, B. "Review: IT-Dependent Strategic Initiatives and Sustained Competitive Advantage: A Review and Synthesis of the Literature," *MIS Quarterly* (29:4), 2005, pp. 747-776.

Pisello, T. "Is There Real Business Value Behind the Hype of SOA?" *Computerworld*, June 19, 2006.

Porter, M. E. *Competitive Advantage: Creating and Sustaining Superior Performance,* The Free Press, New York, 1985.

Porter, M. E. "Strategy and the Internet," *Harvard Business Review* (79), March 2001 pp. 63-78.

Powell, T. C., and Dent-Micallef, A. "Information Technology as Competitive Advantage: The Role of Human, Business, and Technology Resources," *Strategic Management Journal* (18:5), 1997, pp. 375-405.

Powell, T. C. "Competitive Advantage: Logical and Philosophical Considerations," *Strategic Management Journal* (22), 2001, pp. 875-888.

Ravichandran, T., and Lertwongsatien, C. "Effect of Information Systems Resources and Capabilities on Firm Performance: A Resource-based Perspective," *Journal of Management Information Systems* (21:4), Spring 2005, pp. 339-358.

Reed, R., and DeFillippi, R. J. "Causal Ambiguity, Barriers to Imitation, and Sustainable Competitive Advantage," *Academy of Management Review* (15:1), 1990, pp. 88-102.

Rockart, J., and Short. J. "IT in the 1990s: Managing Organizational Interdependence," *Sloan Management Review*, Winter 1989, pp. 7-17.

Sirmon, D. G., and Hitt, M. A. "Managing Resources: Linking Unique Resources, Management, and Wealth Creation in Family Firms," *Entrepreneurship Theory and Practice*, 2003, pp. 339-358.

Srinivasan, K., Kekre, S., and Mukhopadhyay, T. "Impact of Electronic Data Interchange Technology on JIT Shipments," *Management Science* (40:10), 1994, pp. 1291-1304.

Teece, D. J., Pisano, G., and Shuen, A. "Dynamic Capabilities and Strategic Management," *Strategic Management Journal* (18:7), 1997, pp. 509-533.

Truman, G. "Integration in Electronic Exchange Environments," *Journal of Management Information Systems* (17:1), 2000, pp. 209-244.

Walton, R. *Up and Running: Integrating Information Technology and the Organization*, Harvard Business School Press, Boston, MA, 1989.

Wade, M., and Hulland, J. "Review: The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research," *MIS Quarterly* (28:1), 2004, pp. 107-142.

Wernerfelt, B. "A Resource-Based View of the Firm," *Strategic Management Journa* (5), 1984, pp. 171-180.

Whitney, J. O. "Strategic Renewal for Business Units," *Harvard Business Review*, July 1996, pp. 84-98.

Wiggins, R. R., and Ruefli, T. W. "Sustained Competitive Advantage: Temporal Dynamics and the Incidence and Persistence of Superior Economic Performance," *Organization Science* (13:1), 2002, pp. 82-105.

Williamson, O. E. *The Economic Institutions of Capitalism*, The Free Press, New York, 1985.

Yi, M.Y., and Davis, F.D. "Developing and Validating an Observational Learning Model of Computer Software Training and Skill Acquisition", *Information Systems Research* (14:2), 2003, pp. 146-169.